UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

Summary Review of Monthly Reports*
for
SOIL CONSERVATION SERVICE RESEARCH**
APRIL 1947



## EROSION CONTROL PRACTICES DIVISION

Most Beneficial Wind Erosion Control Practices - H. H. Finnell, Amarillo, Texas.-"In attempting to pick out the most beneficial wind erosion control practices, one is faced with the difficulty of meeting an endless variety of field situations stemming from variable seasonal and cropping experiences, as well as different soil groups.

"The aim of the dryland farmer should be to accomplish wind erosion control through precautions incidental to productive cropping. This means the saving and effective use of normal crop residues as a surface protection to the soil. A program of conservation in which the contributing practices support the continuity of vegetative cover derived from regular crops affords the safest known framework for the cropping of semi-arid soils. Continuity achieved by adequate replenishment from the residues of productive crops is perhaps the most beneficial and practical means we know of wind erosion control. For example, a good heavy wheat stubble will protect a field through two windy seasons if well managed. It is the method most to be desired because it is economical. Like many other aims that we set up for ourselves in the field, it can be realized only through the wise selection and skillful application of more than one practice.

"This exception must always be kept in mind. During a sequence of good crop years any fool can do it. In fact, he'd have to go out of his way not to. On the other hand, during a sequence of bad crop years some farmers fall into difficulties much quicker than others, and some stay clear altogether. During the dirtiest of the 1930's there was never a legitimate physical excuse for soil blowing on good land. Three-fifths of the storm dust came from land unfit to cultivate, two-fifths from taking long chances by the neglect of reasonable precautions on good land.

---

*This report is for in-Service use only and should not be used for publication without permission from the Washington Office, Soil Conservation Service Research.

**All Research work of the Soil Conservation Service is in cooperation with the various State Experiment Stations.

"Always an important consideration, demonstrated by our previous wind erosion experiences, is holding the first line of defense. After the loss of protective cover on the surface, preventive measures begin to cost money in the form of extra labor, extra mechanical operations, and possibly the non-productive use of moisture supplies.

"After this first line of defense has been penetrated, circumstances will dictate what is then the most beneficial control practice fitting the needs of a given field. Under certain circumstances the strip or spot furrowing of growing crops may be the only thing left to do, and hence the most beneficial practice for that particular situation. However, in view of the seriousness of erosion hazards and the costs to the farmer or Government, emergency tillage is the last resort, which we should aim to avoid as far as possible. My conclusion about the selection of practices to be supported by the conservation program is that a large variety of sound practices should be offered the farmer with emphasis on his responsibility, with technical guidance, to select those appropriate to the particular time and place for each of his fields. The following outline is presented with the hope of clarifying the relationship of practices to each other and to field conditions:

I. Direct Methods

A. Crop residue management
1. Harvesting so as to leave adequate residue in the field.
2. Regulating grazing and preventing the burning of stubble fields.
3. Delaying soil preparation except for weeds.
4. Using implements that leave trash on top.
5. Planting erosion resistant cover crops when special protection is needed.

B. Tillage
1. Border furrowing growing crops.
2. Strip or spot furrowing growing crops.
3. Wet tillage of bare fields.
4. Timeliness of appropriate normal tillage on bare fields.

II. Indirect Methods

A. Water management
1. Summer fallowing started with abundant residues.
2. Contour farming.
3. Terracing, and contour farming.
4. Strict weed control.

B. Crop Management
1. Choosing hardy and erosion resistant crops.
2. Varying crop sequences to suit production opportunities and erosion prevention needs.
3. Protecting erosion inviting crops by strip farming and/or rotation with erosion resistant kinds.

"From the standpoint of a principle applying to all kinds of soils and affording the most lasting protection, the conservation and management of durable crop residues stands at the top of our list. Next to this, I believe would come the applicable ones of those supporting methods of water and crop management designed to reduce the frequency of crop failure. Of least desirability from the standpoint of economy, but just as urgent in case of need, are the various types of emergency tillage. You will note that I have not singled out a given practice, but have attempted, rather, to designate classes of practices. This is as close as I can come to it."

Recovery of Eroded Land - B. H. Hendrickson, Watkinsville, Ga. "The recovery of eroded land to high productive levels is becoming more and more evident each year. Practical conservation treatments have effected this change. For example, crimson clover now grows rank where it failed on raw Cecil clay subsoil a few years ago. A dense growth of volunteering vetch and Wild Winter peas now supply winter grazing on steep gullied slopes in kudzu pastures. Oats failed on Class IV runoff plots a few years ago. Now, in a lespedeza-based rotation, a 50 bushel per acre yield is in prospect on the same plots. Crop production in general is definitely on the up-grade on all of the Station croplands. The principal conditions responsible are controlled erosion, the consistent use of legume residues and moderate applications of essential minerals."

Erosion Loss Reduced by Vetch Cover Crop After Turning - Russell Woodburn, State College, Mississippi.-"A high intensity rain of 1.83 inches on April 11 gave some very interesting comparisons between soil losses following the turning of vetch and following fallow.

Soil Losses, Pounds/Acre, 1.83 inch Rain 4-11-47

| Slope | 7.5% | 5.0% | 7.5% | 10.0% | 12.5% |
|---|---|---|---|---|---|
| After turning vetch | 0 | 80 | 432 | 4240 | 8804 |
| After turning no vetch | 0 | 360 | 4700 | 13440 | 18328 |

A bare plot 9% slope lost 21960 pounds/acre

"The vetch was not perfectly covered by spading during March so there was a trace of trash still present on the surface. There was, also, a trace of cotton stalks on both sets of plots. It may be seen that the losses from the 10% and 12.5% plots, even following no vetch, were less than those from a 9% bare plot nearby."

Nutrient Loss by Runoff and Erosion - Dwight D. Smith, Columbia, Missouri.-"Mr. Whitt has prepared a preliminary summary of available data on nutrient loss in runoff. These results show:

1. The higher the nutrient content of the soil, the higher the nutrient content of the runoff. This means that the loss of nutrients from the more fertile or fertilized soils is higher per ton of soil loss than the loss from less fertile or unfertilized soils.

2. The texture of the eroded material greatly influences nutrient losses, particularly those nutrients in available form. Nearly all the nutrients available to plants are found in the very finest fraction of the soil--the clay. This size material moves off the field during every runoff period. Losses of nutrients, therefore, can be relatively high even though no gullies develop or large masses of soil are moved. For example, nutrient losses per ton of soil loss is higher from meadow or small grain than from corn."

High Cost of Erosion in Missouri - Good Savings from Conservation Practices - "Conservative estimates, applicable to Missouri upland soils indicate the following losses of potential plant nutrients per ton of eroded material:

| Nutrient | Pounds |
|---|---|
| Organic matter | 100 |
| Nitrogen | 8 |
| $P_2O_5$ (total) | 6 |
| $K_2O$ (total) | 35 |

"The soil loss from a 5-acre field area of 8 percent slope Shelby loam at Bethany, Missouri, was measured at 25 tons per acre per year over an 8-year period. This area was farmed to a 4-year rotation, but without other conservation practices. To replace these potential fertility losses would have required an annual application on each acre of 12-1/2 tons manure, 250 pounds of ammonium nitrate, 440 pounds of 20% superphosphate, and 1500 pounds of muriate of potash. At present prices this would represent an annual cost of $75 per acre.

"A similar area at Bethany farmed to the same rotation but terraced, contour farmed, limed and fertilized lost only 0.6 ton soil per acre from the field each year. To replace this loss in potential fertility would cost only $2.70 per acre per year assuming the nutrient loss per ton of eroded material was 50% higher than for the soil eroded at the rate of 25 tons per acre per year.

"The average soil loss for the cropland of the state including meadow and a part of the plowable pasture land has been calculated to be about 10 tons per acre annually for the present cropping pattern and farming with field boundaries (not contoured or terraced)1/. This area totals about 16,000,000 acres. The value of the annual loss in potential fertility to the State may be calculated from this figure. It is $480,000,000."

Contour-Furrowing Reduced Runoff on Pasture Land - "Runoff this winter and spring from the contour-furrowed bluegrass pasture has been consistently less than from either the renovated or check bluegrass pasture areas for all runoff periods, whether from rainfall or melting snow. Runoff from the check and renovated pastures has been about equal except for two snow

melting periods during March and three rainfall runoff periods during April. A total of 7.76 inches of precipitation occurred from January 1 to April 22, 1947. The resulting runoff from the three areas was as follows:

| Area | Runoff | | |
|---|---|---|---|
| | Inches | Percent | Maximum rate In/Hr. |
| Contour-furrowed pasture | 3.31 | 42.6 | 0.16 |
| Check pasture | 3.75 | 48.3 | .22 |
| Renovated pasture | 4.07 | 52.4 | .24 |

Contour Farming Is Profitable - E. L. Sauer, Urbana, Illinois.- "Contour farming is one of the most widely recommended conservation practices. By preventing runoff of most of the rainfall, contouring conserves moisture needed for plant growth and prevents soil losses. When compared to farming up-and-down the slope on the same farms, contouring has increased grain yields from 12 to 17 percent (Table 2).

Yield Increases for Crops Grown on the Contour Compared to Farming Up-and-Down the Slope on the Same Illinois Farms, Seven-Year Average, 1939-1945.

| Crop | Increase from Contouring | |
|---|---|---|
| | Bushels per acre | Percent |
| Corn | 6.9 | 12 |
| Soybeans | 2.7 | 13 |
| Oats | 6.9 | 16 |
| Wheat | 3.4 | 17 |

"Uninformed farmers have often expressed the opinion that contouring would increase the costs of operating their farms. Records kept on comparable farms show that this is not true (Table 3). Although there is little difference in operating costs of farms that are contour-tilled and farms that are not contour-tilled, the evidence is that contour farming saves labor and that it saves fuel and reduces wear and tear on machinery.

Man Labor Costs and Power and Machinery Costs per Crop Acre on 135 Contour-Tilled Farms Compared with 135 Farms Not Contour-Tilled, Four-Year Average, 1940-1943.

| Item | Contour-tilled | Not contour-tilled |
|---|---|---|
| Man labor costs | $11.20 | $12.04 |
| Power and machinery costs | 7.46 | 7.82 |

Economics of Soil Conservation - "Does soil conservation pay? How much does it cost? How does it affect farm production and earnings? To answer such questions the Department of Agricultural Economics, Illinois Agricultural Experiment Station and the Soil Conservation Service, U. S. Department of Agriculture, began in 1935 a long-time cooperative study of

the costs and benefits of soil and water conservation in selected areas of Illinois. Records were obtained on sample farms of similar land use capabilities but with difference in the extent to which soil and water conservation practices were being followed. Bases on the degree to which needed conservation measures had been applied, a soil conservation score was determined for each farm. Farms with high conservation scores were paired with physically comparable farms with low conservation scores.

"Soil conservation does pay, and the benefits of a conservation program increase from year to year. For example, 10-year records in McLean County show that farms with high conservation scores had lower net incomes per acre in 1936 than farms with low scores. For the five years, 1936-40, however, net incomes per acre averaged $2.36 higher on the farms with high scores and for 1941-45 they averaged $4.17 higher. For the entire period the high score farms had an earned value of about $60 per acre higher than the low score farms. Increased yields on high score farms relative to low score farms was a major factor accounting for the difference in earnings. Similar benefits of conservation have been demonstrated in all other areas of the state."

Sub-tillage Compared with Plowing Increased Microbial Population Within Plow-depth - F. L. Duley, Lincoln, Nebraska.-"In laboratory studies on some of our field plots, Dr. Roy C. Dawson is preparing a manuscript for publication in which he shows that the number of organisms in the surface inch of soil on stubble mulched land is significantly higher than where the residue is plowed under. The following table gives a summary of results.

Mean density of microbial populations within the plow-depth layer of soils in which residues were subtilled and plowed.

| Depth | Subtilled | Plowed | Mean Difference | Std. Error of Mean Difference |
|---|---|---|---|---|
| | Fungi in thousands per gram of soil | | | |
| 0-1" | 231.08 | 164.17 | 66.91** | 15.98 |
| 1-6" | 226.83 | 225.67 | 1.16 | 13.41 |
| 0-6" | 225.80 | 214.60 | 11.20 | 10.01 |
| | Bacteria plus Actinomyces in Millions per gram of soil | | | |
| 0-1" | 36.57 | 20.89 | 15.68** | 4.42 |
| 1-6" | 29.70 | 29.11 | 0.59 | 2.51 |
| 0-6" | 30.90 | 27.80 | 3.10 | 1.70 |

** Significant at the 1% level.

Effect of Stubble Mulching Versus Plowing on Physical Properties of Soil - "Another study on the effect of stubble mulching on the physical properties of the soil has been made of José Manuel Pereyra of Argentina, S. A., who has just completed work here at the University of Nebraska for the Master's Degree. His results show no significant difference in late fall between stubble mulched and plowed land grown to corn, in volume weight, pore space, or resistance to penetration with a soil tube. He did, however, find that

the stubble mulched land had soil aggregates in the surface inch that were more resistant to the action of falling water drops, and it also had a greater number of aggregates over 25 mm. in diameter. This more stable structure produced on the stubble mulched land may be of considerable importance in water relation and aeration in the surface layer of soil. A summary table showing these results follows:

Effect of stubble mulching versus plowing on soil structure of 0-1" depth of soil.

| Crop | | | No. water drops to destroy .1 g. lumps | | Percent aggregates >0.25 mm. diameter | |
|---|---|---|---|---|---|---|
| 1944 | 1945 | 1946 | Stubble mulched | Plowed | Stubble mulched | Plowed |
| Wheat | Sweetclover | Sorghum | 40.8 | 36.4 | 10.5 | 8.0 |
| Wheat | Sweetclover | Corn | 39.4 | 33.5 | 12.8 | 10.1 |
| Sweetclover | Sorghum | Corn | 35.2 | 31.0 | 6.4 | 6.6 |
| Sweetclover | Sweetclover | Sorghum | 38.2 | 33.3 | 12.9 | 8.5 |
| Sweetclover | Sweetclover | Corn | 41.1 | 32.1 | 10.9 | 8.1 |

These differences between stubble mulching and plowing are significant at the 1% level in the case of water drops required to destroy lumps and at the 5% level for percent aggregates >0.25 mm."

Feeding Your Crops Vs. Feeding Your Neighbors' Crops, the Cat-Tails, and the Fish - G. R. Free, Marcellus, New York.-"Last summer, samples of soil washed from slopes by recent rains were obtained from seven farms in Cayuga County and from two sets of plots at the Marcellus Station. At the same time, samples to plow depth of the soil left on the slopes were obtained. In all cases but one the samples of deposited soil were considered to be as nearly representative of the material washed from the slopes as possible with such a procedure. Obviously the soluble materials and the very finest fractions of soil could not be recovered except by setting up equipment to catch or sample all runoff water and soil. In the one case, erosion had been particularly severe, and the freshly deposited soil which was sampled was about one foot deep along a fence row. This represented only the coarser fraction of soil, and the fine material was in and along the creek below. These samples were recently analyzed (organic matter by E. A. Carleton; other analyses were arranged by Professor M. H. Peech). Every one of the eight samples of deposited soil contained more organic matter than the corresponding samples of soil left on the slope. The average for the eight deposited soils was 3.7 per cent, compared to 2.9 per cent for the slopes. Seven of the samples of deposited material contained more K than the slope samples, and one contained the same amount. Five samples of deposited material contained more P than the slope samples, two the same amount, and only one less. The results of analyses for magnesium, calcium, and ammonia and nitrate were less consistent with respect to differences between deposition and slope, but all showed appreciable amounts of these elements present. The one sample of coarse, deposited material contained less

organic matter than the soil left on the slope, but it contained more P. Anyone buying any of these elements in the form of commercial fertilizer, and anyone needing to maintain or build up soil organic matter, should be interested in these data. These people should also be interested in the New Jersey data of a few years ago showing the P and K to be in a more available form in the wash-off than in the soil which is left."

Grazing Studies - C. J. Whitfield.-"Excellent gains were made during the first month of the summer grazing season. The top was an average of 3.17 pounds per day on wheat; crested wheat a close second with 3.03. All pastures showed exceptionally well, however, the lowest being western wheat, with 1.9.

"Cattle were placed on the pastures, except for I-1, native bluegrama-buffalo, and F-1, weeping lovegrass, which were deferred. Wheat made excellent growth during April, although it was checked somewhat during the last half because of cold weather. A late snowstorm on April 12 covered the ground, and the continued rain melted it, to leave the ground muddy. The steers were placed on native grass during this 5-day period. A good rain, on April 24, further increased the soil moisture, and should maintain forage growth into May.

Cattle Gains for April on Wheat, Native, and Seeded Pastures

| Lot No. | Number of Steers | Pasture No. | Acres | Grasses | Daily Gain Pounds |
|---|---|---|---|---|---|
| 10 | 10 | H | 311 | Blue grama-buffalo and western wheat grasses | 2.28 |
| 4 | 10 | H | 311 | Blue grama-buffalo and western wheat grasses | 2.30 |
| 5 | 25 | J-2 | 93 | Wheat forage -- some bundle feed | 3.17 |
| 1 | 10 | I-4 | 44 | Crested wheatgrass | 3.03 |
| 3 | 10 | I-2(E) | 44 | Blue grama, western wheat-grass mixture | 2.93 |
| 2 | 10 | F-2 | 44 | Western wheatgrass, seeded | 1.90 |

Supplementary Grazing Can be Had by Using Hard Seeded Winter Annuals in Lespedeza Sericea Plantings. - Joseph C. Moore, Auburn, Alabama.- "In the fall of 1946 manganese bur clover, caley peas and crimson clover were sown on a Lespedeza sericea sod. Part of the soil was rilled lightly with a disk after the seed were sown and part was left undisturbed. Good stands were obtained by each method of planting. 2,000 lb. of limestone was added to the Lespedeza sericea sod in the spring of 1946. Lime is very beneficial to the winter legumes used in this planting. These legumes will be allowed to make a seed crop this spring so that they may volunteer again next fall."

Oats Planted in Kudzu Makes Good Hay and Aids in the Destruction of Broom Sedge and Briars that have Damaged the Stand of Kudzu - "The kudzu was cut down with a heavy disk in the fall before the oats were sown.

"After the oats were sown the area was recut with a heavy disk to cover the seed.

"The oats will be cut for hay and followed by grain sorghum which will be cultivated enough to complete the eradication of broom sedge and briars."

Quantity of Organic Material Plowed Under on Various Winter Cover Crop and Land Resting Treatments - O. R. Neal, New Brunswick, New Jersey.- "The quantity of plant material in tops and roots at the time of plowing was measured for three winter cover crops and five land resting treatments. Results are shown below:

| Treatment and Crop | Oven-dry material - Tons per acre | | |
|---|---|---|---|
| | Tops | Roots | Total |
| Winter cover crops: | | | |
| Rye | 0.60 | 0.82 | 1.42 |
| Ryegrass | .46 | .55 | 1.01 |
| Ryegrass and vetch | 1.25 | 1.06 | 2.31 |
| Land-resting treatments: | | | |
| Ryegrass and vetch, seeded fall of 1945 - natural reseeding in 1946 | 1.47 | 1.53 | 3.00 |
| Clover, timothy and alfalfa seeded fall of 1945 | 1.92 | 4.92 | 6.84 |
| Rye following broadcast corn in 1946 | 1.94 | 1.08 | 3.02 |
| Rye following soybeans in 1946 | 3.82 | 2.45 | 6.27 |
| Lespedeza sericea seeded spring of 1945 | 7.90 | 3.93 | 11.83 |

"The above figures include only plant material that is recognizable at the time of plowing. Material that has decomposed so that plant parts cannot be identified is not included. In the case of the winter cover crops practically all of the plant material produced is measured. In the land resting treatments where two winters and one growing season have elapsed, considerable quantities of plant material have already been partially decomposed.

"Ryegrass and vetch as a winter cover produced much more organic material than did either rye or ryegrass alone. Sweet corn yields following ryegrass and vetch have been considerably higher than those following either of the other winter cover crops.

"The quantity of organic material plowed under following the different land resting treatments varied widely. The growth of rye following disced-down soybeans was much greater than that following broadcast corn. Lespedeza, which had occupied the land for two full years, furnished an average of nearly 12 tons of organic matter per acre. This quantity is equivalent, in amount, to the organic matter in 60 tons of manure.

"These several land resting treatments are known to be effective in reducing soil and water losses. During the current season sweet corn will be grown on all areas to determine the effect of the treatments on the yield of a cultivated crop."

Winter Cover Crops and Seeding Dates - Karol J. Kucinski, Amherst, Massachusetts.-"Winter rye, oats and barley were seeded on the Station farm at weekly intervals during the fall of 1946, beginning September 1 through the last week in November.

"Winter rye produced the best cover crop when it was sown during September and October. The seedings made during the last week of March could not be considered satisfactory.

"Oats and barley produced a cover which winter killed, leaving a desirable protective mat when sown before the middle of October. The mat could easily be disced this spring and not interfere with any onion planting operation. The seeding made after October 15 could not be considered as giving any protection from water or wind erosion. These results are quite similar to results obtained in tests of previous years."

Maximum Curvature for Grape Rows - John Lamb, Jr., Ithaca, N. Y.- "Mr. John W. Slosser, Project Supervisor, Soil Conservation Research at Orono, Maine, directed a study at Hammondsport, April 7-9, to determine the limits of grape-row curves that could be cultivated with ordinary power tools. Stakes were used to represent grape vines. His conclusions were as follows:

1. With integral equipment, it appears that there is little difficulty in cultivating the curved rows of contour vineyard plantings.
2. Concave curves offer the most difficulty.
3. With integral equipment available, an angular deviation of 137° is readily handled. This corresponds to a deviation of 2.9 feet with vines 8 feet apart in the row. Divergence was determined by measuring the distance from the center vine to a line passing through the adjacent vines on each side.
4. The operation of integral equipment can be improved by: (a) setting rear-drive wheels at narrowest width, and (b) keeping side slack in implement well taken up.
5. With drawbar equipment of maximum length used, an angular divergence of 171° can be handled by careful driving. This corresponds to a deviation of 1.2 feet with vines 8 feet apart in the row. The use of a draw-bar shifter will

permit operation on more acute angles and improve overall performance.

6. The operation of trailed equipment can be improved by: (a) shortening the hitch, (b) proper weighing and setting, (c) moving the draft point forward, and (d) maintaining accurate adjustments.

Note: Mr. Slosser is an authority on adapting machinery to contour cultivation. We were indeed fortunate that he was available to help us in an emergency on such short notice. In fact, he seemed happy to be away from the "snow country". Details of this test will be sent on request."

Another Season of Deficient Rainfall in Southern California - Maurice Donnelly, Riverside, California.-"In a report issued in 1943 (Donnelly, CALIFORNIA CULTIVATOR, April 3, 1943, p. 182) it was predicted that California was at or near the beginning of a dry era. Average annual rainfall for Los Angeles for the past 70 years is about 15-1/2 inches. Rainfall for 1944-45 was below normal, and amounted to 11.6 inches. The winter of 1946 was below normal and the past winter, 1947, is one of the driest in history. The average rainfall by months, compared with the actual rainfall for 1945-46 and 1946-47, is given in the table below:

RAINFALL, LOS ANGELES
(in inches)

| | July | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | March | Apr. | May | June | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Average 67 years 1877-1944 | 001 | 003 | 0.22 | 0.64 | 1.10 | 2.84 | 3.08 | 3.39 | 2.76 | 1.07 | 0.38 | .08 | 15.60 |
| 1945-1946 | - | - | - | 0.56 | 0.23 | 5.05 | 0.11 | 1.52 | 3.66 | 0.44 | 0.04 | - | 11.61 |
| 1946-1947 | - | - | 0.02 | 0.92 | 6.04 | 3.47 | 0.38 | 0.44 | 0.79 | | | | Total to 3-30 12.06 |

"Even more important than the seasonal totals in arriving at a measure of the drought of the past two years, is the deficiency in the "rain crop" for these two years over much of southern California. This rain crop is the amount of water that falls as rain (or to a very limited extent as snow) over and above consumptive use on the area where precipitation takes place. The bulk of the rain crop is ordinarily harvested from rains in January, February and March, which it will be noted in the table above, were low in 1946, and practically nil in 1947.

"This drought has already caused serious dislocations in some of the agricultural sections of the State. If it continues it may be expected to have important effects in soil and water conservation programs."

Lime, Sweet-Clover and Soil Nitrogen - F. L. Duley, Lincoln, Nebraska.-"Lime has been of so much value in sweetclover production on the Agronomy farm here that it suggests the possible need for more widespread use of it in much of southeastern Nebraska. The yield of sweetclover the first year has been about doubled and nodule production and consequent nitrogen fixation greatly improved where lime is used on this soil.

"The value of a large supply of available nitrogen in this soil is very evident on the wheat crop this spring. Wheat in the sweetclover rotations has a dark green color and heavy growth, which is in striking contrast to the wheat on land where no legumes have been grown."

Soil Aggregates in Relation to Crops and Cropping Practices - G. M. Browning, Ames, Iowa.-"The aggregate analysis determination on samples taken during 1946 from the control plots are completed. Samples were taken at monthly intervals from April to November with the exception of October. With few exceptions the highest aggregation was reached in July or August with the various cropping systems. The following table shows the average relative aggregation for the year in percent, using continuous corn as 100.

Relative aggregation of 8 sampling dates, Marshall silt loam, Clarinda, Iowa 1946.

| | |
|---|---|
| Continuous corn 1931-46 | 100 |
| Corn 1931-42; Rotation corn-oats-meadow 1943-46 | |
| Corn | 135 |
| Oats | 115 |
| Meadow | 157 |
| Rotation Corn-Oats-Meadow 1931-46 | |
| Corn | 174 |
| Oats | 154 |
| Meadow | 203 |
| Alfalfa 1931-42 Corn 1943-46 | 148 |
| Bluegrass 1931-42; Corn 1943-46 | 158 |
| Bluegrass 1931-46 | 262 |

Late-Fall Protection of Summer-Cropped Land Favors Earthworms in the North Central States - Henry Hopp, Beltsville, Maryland.-"This past month, Clarence Slater and I checked the effects of late-fall protection on the survival of earthworms at a number of locations in the north central states. The results bore out findings previously reported from Beltsville, Maryland, that with adequate fall protection, the earthworm population will be at a high level in the spring despite clean-tillage the previous summer. Samples of the results are as follows:

| Location | 1946 Crop | Type of Fall Protection | Earthworms per Sq.Ft.-7" Deep | |
|---|---|---|---|---|
| | | | Number | Weight (grams) |
| Zanesville, Ohio | 1. Corn, winter wheat | a. None | 32 | 10.2 |
| | | b. Mulch | 53 | 17.9 |
| | 2. Strawberries | a. None | 0 | 0.0 |
| | | b. Straw | 9 | 3.4 |
| Morgantown, W. Va. | 3. Corn | a. None | 9 | 1.3 |
| | | b. Heavy paper | 34 | 4.9 |
| | | c. Clover (interseeded in corn) | 40 | 4.3 |
| LaCrosse, Wisc. | 4. Pasture | a. Fall plowed | 25 | 11.2 |
| | | b. Fall subtilled | 41 | 23.6 |
| Holgate, Ohio | 5. Corn annually | a. None | 0 | 0.0 |
| | | b. Stover | 9 | 7.9 |
| | | c. Grass mulch | 10 | 9.3 |
| | 6. Soybeans annually | a. None | 0 | 0.0 |
| | | b. Haulm | 3 | 2.9 |
| | 7. Corn (rotation) | a. None | 27 | 4.2 |
| | | b. Stover | 103 | 11.0 |
| | 8. Soybeans (rotation) | a. None | 13 | 7.2 |
| | | b. Haulm | 62 | 23.4 |
| | 9. Oats (rotation) | a. Stubble | 10 | 3.1 |
| | | b. Combine residue | 26 | 7.9 |
| | 10. Alfalfa (rotation) | a. None | 26 | 7.3 |
| | | b. Mulch | 118 | 44.4 |
| Lansing, Mich. | 11. Sod (4-year rotation) | a. Winter rye(fall plow) | 2 | 1.2 |
| | | b. Stubble and manure | 13 | 7.5 |
| | 12. Wheat (rotation) | a. Binder residue | 20 | 10.6 |
| | | b. Combine residue | 20 | 14.2 |
| | 13. Wheat (rotation) | a. Light residue | 2 | 0.6 |
| | | b. Heavy residue | 13 | 6.8 |
| Wooster, Ohio | 14. Corn, plowed for winter wheat | a. None | 13 | 2.4 |
| | | b. Stover | 43 | 10.3 |
| | | c. Manure | 44 | 16.5 |
| | 15. Corn, subtilled for winter wheat | a. Stover | 46 | 18.8 |
| | | b. Manure | 51 | 16.9 |
| Frederick, Md. | 16. Corn, winter wheat | a. None | 10 | 1.4 |
| | | b. Hay mulch | 85 | 4.6 |

"Attention is called to the extraordinarily large concentration of earthworms in many of these soils (for example 44.4 g. in comparison No. 10 corresponds to over 2 tons of earthworms per acre); the uniformity in effectiveness of fall covering in maintaining the earthworms; and the relative ineffectiveness of winter grains. These results point to a way of conserving a soil-granulating factor which, in ordinary farming, is greatly reduced by row cropping."

DRAINAGE AND WATER CONTROL DIVISION

Hydrologic Studies - L. L. Harrold, North Appalachian Experimental Watershed, Coshocton, Ohio.-"Rain falling at low rates on soil that is high in moisture caused very little surface runoff. Of the 4 inches that fell in April, not more than 0.01 inch ran off the land surface. As the moisture in the soil was well above field capacity, percolation rates and amounts were large. About 2 inches of water percolated from the 8-foot lysimeters. The rate of percolation at the end of the month was about 0.07 inch per day. At this time, the rate of stream flow from a 300-acre watershed was 0.08 inch per day. Total stream flow from this watershed for the month was 2.42 inches - somewhat greater than the total percolation. It is readily seen that there can be considerable stream flow from large agricultural areas even though there is no surface runoff over the farm fields. This occurs only when soil moisture is high.

"The amount of precipitation for two months prior to April was extremely low (0.37 inch in February and 0.74 inch in March), yet soil moisture was well above normal. This was observed on a well-drained Muskingum silt loam. Hydrologic conditions in the first 3 months of the year fit together to make the following picture:

> January precipitation of 4.84 inches was mostly rain with practically no frost, and low rainfall rates, infiltration was almost 100 percent. Soil profile was nearly saturated and percolation rates were high by the end of the month. Low temperatures from February 1 to March 20 resulted in continuous frost penetration except for only 2 days. Accompanying the freezing of the soil surface was a sharp decrease in percolation - January 31 = 0.42 and February 4 = 0.06 inch per day. The frozen soil had the character of dense concrete. Perhaps this prevented air intake into the soil and thereby reduced the emptying of soil pores by percolation. Apparently, the soil profile held much water above field capacity, although only a small part of the profile was frozen. When frost left the soil, water was released and percolation rates increased.
>
> Soil moisture remained well above normal throughout February and March. Normal percolation for February and March for such a high moisture content would be somewhat above 3.5 inches. In 1947 the percolation for this period was 1.3 inches. About half of this occurred the last 10 days of March when there was no frost; the other half in the preceding period when there were 46 days of frost. Consequently, the amount of water in the 40-inch soil profile on April 1, was about 2 to 3 inches greater than would have occurred had there been no frost in the ground. It is apparent that antecedent precipitation data alone could not forecast soil moisture values for April of this year.

"Leonard Schiff gave a paper entitled 'Infiltration, Soil Moisture, and Land Use Relationships With Reference to Surface Runoff' at the American Geophysical Union."

Hydrologic Studies - R. B. Hickok, Lafayette, Indiana.-"Total rainfall averaged 7.50 inches at the Throckmorton Farm, and slightly less at the Dairy Farm watersheds. This is approximately double the probable mean April rainfall for Lafayette. A total rainfall at the Throckmorton Farm of about 1.90 inches on April 29-30 produced the following total runoffs from experimental watersheds in rotation crops:

Total runoff from experimental watersheds, Purdue-Throckmorton Farm, Lafayette, Indiana, April 29-30, 1947

| Crop | Treatment | Wsd. No. | Total runoff, Inches |
|---|---|---|---|
| Fallow 1/ | Prevailing | 5 | 0.88 |
| | | 8 | 0.22 |
| | Conservation | 6 | 0.19 |
| | | 7 | None |
| Wheat | Prevailing | 10 | 1.05 |
| | | 15 | 0.24 |
| | Conservation | 18 | 0.45 |
| | | 14 | 0.62 |
| Meadow | Prevailing | 4 | 0.19 |
| | | 12 | 0.74 |
| | Conservation | 2 | 0.41 |
| | | 11 | 0.42 |

1/ Corn stalks disced down in early winter, following direction of rows (contoured on conservation treated watersheds).

"It is interesting to note that water losses from wheat continued generally higher than from last year's corn watersheds on which stalks had been knocked down in early winter. The water losses were very low from the fallow conservation watersheds where heavy corn residues were laid down in the direction of the contoured rows.

"Permanent pasture watersheds produced runoff from continuous lateral seepage over long periods, with relatively high total water losses.

"Runoff samples were collected for six runoff periods from several watersheds, making a total of 32 aliquot samples for the month. Analyses are partially completed for these samples. In addition to the aliquot samples, a series of periodic samples were manually collected from two watersheds during the storm of April 29-30, for the study of variations in concentrations of total solids and comparison of the integrated total solid losses with those obtained from composite samples taken by the automatic aliquot samplers.

"Total solid losses for the April 29-30 storm are shown in the following table:"

Total solid losses from experimental watersheds, Purdue-Throckmorton Farm, Lafayette, Indiana, April 29-30, 1947.

| Crop | Treatment | Wsd. No. | Total solid loss, lbs./acre |
|---|---|---|---|
| Fallow 1/ | Prevailing | 5 | 563 |
| | | 8 | No sample (equip. failure) |
| | Conservation | 6 | 52 |
| | | 7 | None |
| Wheat | Prevailing | 10 | 214 |
| | | 15 | 61 |
| | Conservation | 18 | 69 |
| | | 14 | 67 |
| Meadow | Prevailing | 4 | 25 |
| | | 12 | 27 |
| | Conservation | 2 | 37 |
| | | 11 | 25 |

1/ Corn stalks disced down in early winter, following direction of rows (contoured on conservation treated watersheds).

Hydrologic Studies - R. G. White, East Lansing, Michigan.- "The antecedent effects of frost and frozen soil on infiltration and runoff were definitely demonstrated during the storm of April 5. During this storm 2.77 inches of rain fell at the cultivated watersheds and 2.41 inches at the wooded watershed. Details of the storm are given in the following table:

| | Watershed A | Watershed B | Wooded |
|---|---|---|---|
| Cover | Corn Stubble (Rye W. C.) | Brome-Alfalfa Sod | Woodland |
| Total rainfall, inches - from Fri. noon to Sat. midnight | 2.77 | 2.77 | 2.41 |
| Inches rainfall, contributing to runoff | 2.48 | 2.48 | 2.41 |
| Inches runoff* | 1.75 | 0.54 | 0.74 |
| Percent runoff* | 70.4 | 21.8 | 30.7 |
| Soil loss, lbs. per acre | 1009 | 0 | 0 |
| Peak rainfall intensity, in./hr. | 2.10 | 2.10 | 1.50 |
| Time of occurrence | 3:28 AM | 3:28 AM | 3:34AM |
| Peak rate of runoff, in./hr. | 1.77 | 0.66 | 0.10 |
| Time of occurrence | 3:36 AM | 3:40 AM | 11:07AM |
| Duration of runoff | 14 hrs.6min. | 9 hrs. 18 min. | 29 hrs.29min. |

* Snow melt contributed to runoff

"There was some snow on the ground at the beginning of the storm, but it was all gone when the storm ended. At the cultivated watersheds snow cover was quite similar on both watersheds. Snow covered about one-third of the watershed area, mostly in the form of drifts. While specific information is lacking, it is estimated that not more than 0.25 inch of water lay on the watershed area in the form of snow at the beginning of the storm. At the wooded watershed the snow cover was quite uniform in depth and probably did not exceed a water equivalent of 0.40 inch. Here likewise, all snow had disappeared by the end of the storm.

"At cultivated watershed 'A' there was a thin layer of frozen soil at the 12-inch depth at the beginning of the storm, while at watershed 'B' there was an equally thin layer of frozen soil at the 6-inch level. At both watershed 'A' and 'B' all frost had disappeared at the end of the storm. There had been frozen soil at both the cultivated watersheds continuously since December 14. At the wooded watershed there had been no frozen soil at any time during the winter.

"The unusual aspect of this storm is the fact that there was more runoff from woodland than from brome-alfalfa sod. While the peak rate of runoff was much lower from the woodland, the duration of runoff was much greater, and the total quantity of runoff was approximately 44 percent greater. While a certain portion of this increased quantity of runoff from woodland was due to the greater amount of snow on the ground at the beginning of the storm, the fundamental reason is largely due to the antecedent frost conditions. At the cultivated watersheds the soil had been frozen to a depth of 18 inches throughout the month of March, with surface melting commencing on March 24. As a result, much of the snow melt occurring during March was lost as surface runoff, and the moisture content of the soil below the frost layer ranged from 7 to 9-1/2 percent. At the wooded watershed there was no frozen soil at any time during the winter and all snow-melt prior to the storm of April 5 went into the soil with no runoff loss. The moisture content of the woodland soil ranged from 25 to 35 percent in the surface 36 inches. Thus, with woodland soil completely saturated, it was unable to hold permanently as much of the rain as was the brome-alfalfa sod which had considerable moisture storage capacity as soon as the last trace of frost had disappeared.

"The absence of a peak rate of runoff immediately following the peak rainfall intensity at the wooded watershed was due to the presence of a uniform snow blanket when rainfall started. This snow blanket, along with forest floor litter, trapped and held temporarily the peak periods of rainfall, releasing the surplus water as runoff over a longer period of time."

Hydrologic Studies - R. W. Baird, Waco, Texas.-"The following table shows the runoff amounts and peak rates for the days on which there was appreciable rainfall and total runoff at four stations for the first 27 days of the month. The total runoff includes the ground-water flow.

Maximum runoff rates in inches per hour and total amounts in inches

| Date | Sta. W-1 | | Sta. W-2 | | Sta. Y | | Sta. Y-2 | | Sta. 69 |
|---|---|---|---|---|---|---|---|---|---|
| April | Amount | Max. rate | Amount | Max. rate | Amount | Max. rate | Amount | Max. rate | Rainfall |
| 10 | 0.0035 | 0.0003 | 0.0107 | 0.0006 | 0.0010 | 0.0001 | None | | 0.03 |
| 12 | .0056 | .0013 | .0153 | 0018 | .0030 | .0006 | T | .0001 | .43 |
| 13 | .0034 | .0002 | .0135 | .0009 | .0029 | .0003 | .0004 | T | .03 |
| 14 | .0084 | .0023 | .0173 | .0017 | .0099 | .0035 | .0063 | .0021 | .35 |
| 19 | .0789 | .192 | .0408 | .0665 | .0201 | .0161 | .0159 | .0110 | .58 |
| 25 | .1177 | .0576 | .1278 | .0427 | .1331 | .0307 | .1223 | .0355 | 1.24 |
| 26 | .0088 | .0008 | .0167 | .0009 | .0112 | .0007 | .0061 | .0004 | .09 |
| 27 | .0086 | .0004 | .0176 | .0008 | .0115 | .0007 | .0062 | .0004 | .01 |
| Total | .2866 | | .4696 | | .2288 | | .1708 | | 2.76 |

"The amount of runoff from the storm of April 25 was nearly the same for the four areas. The areas Y and Y-2 have conservation practices, and areas W-1 and W-2 are cultivated in the usual manner with straight rows. The amount of seepage or ground water flow has been consistently higher from the W-2 area than from the other areas since the stations were established in 1937."

Runoff Studies - V. D. Young, Fayetteville, Arkansas.-"The monthly rainfall on the Muskogee Watersheds varied from 5.40 inches to 6.86 inches with a mean for the four watersheds of 6.18 inches. This was 1.61 inches more than the 1945 Weather Bureau Normal for Muskogee. The highest observed discharge of 0.924 c.f.s. per acre occurred from Watershed W-III (lespedeza and weed pasture) on April 29th. The next highest of 0.647 c.f.s. per acre occurred on the same date from the 65.3-acre terraced area in mixed crops.

"The highest observed rate on the meadow-pasture area (W-IV) occurred on the 24th and was 0.486 c.f.s. per acre. The highest observed rate on W-I occurred on the 8th and was 0.369 c.f.s. per acre.

Runoff Studies - N. E. Minshall, Madison, Wisconsin.-"Precipitation at Edwardsville for the month was 6.55 inches, as compared to a normal of 4.0 inches. The precipitation was well distributed, with rainfall on 14 days. Runoff from the 50-acre pastured watershed totaled 4.05 inches. The largest daily rainfall was 1.83 inches on April 29, of which 1.4 inches fell in less than 2 hours, with a total runoff from the pastured area of 1.2 inches. Maximum intensity during this storm for various intervals were:

5 minutes - 3.84 in/hr.
15 minutes - 2.60 in/hr.
30 minutes - 1.88 in/hr.

Peak rates of runoff for this storm were:

28-acre cultivated watershed - 1.44 in/hr.
50-acre pastured watershed - 1.55 in/hr.
290-acre mix-cover watershed - .92 in/hr.

Although the peak rate of runoff from the cultivated area is less than from the pasture, the total runoff from these two areas is almost identical."

Hydraulic Studies - F. W. Blaisdell, Minneapolis, Minnesota.-"Mr. Anderson ran tests on the drop inlet spillway with the pipe conduit 100 diameters long, laid on a 5 percent slope. Data for both this test length and for the pipe laid on a 2-1/2-percent slope were analyzed. The friction factor for the lucite tubing was found to agree satisfactorily with the published friction factors for smooth tubes. The bend

loss coefficient for the 2-1/2-percent slope was found to average 0.97 while previous tests with the pipe 20 diameters long gave a value of 0.96. This coefficient for both lengths of pipe laid on a 5-percent slope is 0.99. Most of the pressure data has been recorded by photographing the manometer board. For the 5-percent slope two runs were made using point gage measurements to check the precision of the photographic method. Analysis of the results obtained by the two methods indicated that the greater number of runs made by the photographic methods will give as accurate values as can be obtained by a smaller number of runs made using the point gage. Approximately the same overall time is required to obtain comparable results of either method."

Hydraulic Studies - W. O. Ree, Stillwater, Oklahoma.-"The first experiments of the season were run early in April. These were:

| Channel | Expt. | Cover | Bed Slope | No. of Flows |
|---|---|---|---|---|
| FC1A | 2 | Grass Mixture | .03 | 6 |
| FC1B | 2 | " " | .06 | 6 |
| FC2A | 2 | Weeping Lovegrass | .03 | 5 |
| FC2B | 2 | " " | .06 | 5 |
| FC3A | 4 | Bermuda Grass | .03 | 7 |
| FC3B | 4 | " " | .06 | 7 |

"These channels have triangular cross-sections with side slopes of 1 on 10. Their width is approximately 40 feet. The maximum flow used was 142 cubic feet per second.

"The preliminary calculations have been completed for channels FC1A and FC1B and some results can be offered at this time.

"These channels are lined with native grasses. Bermuda predominates in the center portion while little bluestem is the principal grass on the sides. There is also a scattering of other grasses such as side oats grama, blue grama, western wheat. The cover is starting its 4th season and has never been mowed

"At the time of these spring tests much of the grass was either dead or dormant. Also considerable rain fell about the time of these tests. The combination of dormant vegetation and very wet channel bed resulted in a generally poor condition for the channel. It was an excellent time to test since field channels were in similar conditions and were being subjected to natural runoff.

"The low values of Mannings n obtained from these spring tests were rather surprising. Channel FC1A fell into retardance group D and channel FC1B into retardance group D plus. The testing last fall resulted in retardance groups C and C plus respectively. The principal change in the cover from fall to spring was the dormancy of the spring cover. Its density and length had not changed.

"Channel FC1A started to show some scour at a velocity of 4.1 feet per second. However it was not seriously damaged by the final flow which had a velocity of 6.0 feet per second. It is believed that a safe velocity for this channel in its condition is about 4.0 feet per second. Channel FC1B showed scour at a velocity of 3.9 feet per second. Considerable scour took place when the velocity reached 5.7 feet per second. The safe velocity for the steeper channel is about 3.7 feet per second."

SCS-TP-61, "Handbook of Channel Design for Soil and Water Conservation" was released during the month and is available for distribution.

Sedimentation Studies - C. B. Brown, Washington, D. C.-"Considerable time was spent this month in making preparations for the sedimentation conference sponsored by the Federal Inter-Agency River Basin Committee to be held in Denver, Colorado, May 6-8, 1947. I prepared two papers for the conference, entitled 'Perspective on Sedimentation' and 'How Effective are Soil Conservation Measures in Sedimentation Control?' L. C. Gottschalk prepared a paper on 'Analysis and Use of Reservoir Sedimentation Data.' In connection with this paper, some time was spent in analyzing data on compaction of sediment obtained from experiments conducted several years ago at Greenville, S. C. These compaction curves show very definite relationships of porosity or volume-weight with time and with loading of additional over-burden of the same type of sediment. Fine sediment composed of silt and clay from a local reservoir was used in making the experiments."

Sediment Studies - Vito A. Vanoni, Cooperative Laboratory, California Institute of Technology, Pasadena, California.-"The principal measurements in the experiments in the 33-inch flume are the measurement of velocity and the sediment distribution over the cross-section of the flow. Experiments in the past were with relatively fine sediments that were easy to suspend and transport. The present series of experiments uses a sediment with an average size of 0.25 mm which is considerably coarser than any used before. With this sediment the rates of transportation are considerably smaller and a number of interesting phenomena have been encountered that did not appear in the previous experiments with finer sediments. Among these is the tendency for the flow to sort out the sediment and to suspend more of the smaller grains than of the coarser ones. The evidence on this is by no means conclusive, and final conclusions regarding this action must be deferred until more study can be given to the problem.

"Two papers and two discussions were prepared for the Denver sedimentation conference. These are as follows:

1. 'Determination of Rates of Bed-Load Movement' by H. A. Einstein.
2. 'Determination of the Mechanics of Sediment Transportation in Channel Flow' by Vito A. Vanoni.
3. Discussion by Robert T. Knapp of 'Applicability of Model Studies to Sediment Problems in Navigation Channels.'
4. Discussion by John T. O'Brien of 'Stabilization of Banks of Rivers in the Lower Mississippi Valley.'

"Experiments were continued to study the effectiveness of the bank roughness on stream bank control. These experiments are carried out in a laboratory channel molded in fine sand. The sediment eroded from this bed is circulated with the water so the stream entering the erodible section is actually carrying appreciable amounts of sediment. Although there are certain inconsistencies in the data, the cause of which is now known, the results seem to indicate that roughening the banks is an important aid to controlling bank erosion. Practically, the roughening of the banks can be accomplished by vegetation. These experiments, then, indicate the desirability of using vegetation on the banks. By this laboratory method it appears possible to obtain a much more specific idea of the benefit to be obtained by vegetation than has been possible heretofore.

"A second series of experiments on this study was started in the 10-inch-wide sediment flume used on sediment transportation experiments. These experiments are to investigate the effect of artificially roughening the bed of a stream on the stable grade that the stream assumes. The idea is that if this artificial roughness can appreciably steepen the equilibrium grade, then this method of preventing degradation could be used instead of the much more expensive method now used of installing drops or check dams. The laboratory channel is roughened by one-half inch diameter rods extending a short distance above the sand bed."

Drainage Studies - M. H. Gallatin, Homestead, Florida.-"During the past period we have added three more cooperative areas. We have now included in our studies of nitrate losses Uramon, Cyanamid, Sodium nitrate, and the regular application of complete commerical fertilizer. This study should give us some data on the stability of the various forms of nitrate insofar as its ability to withstand our climatic conditions is concerned. We hope to set up, in cooperation with the Sub-Tropical Experiment Station, studies along these same lines in quadruple plots to study the effect of rainfall in the leaching of Uramon, Ammonium Sulfate, Uramon, and Sodium Nitrate.

"Analysis of the samples from the three salt lines for the past period shows as follows: Sampling of the Tamiami, Biscayne, and Little River Canal areas show that in one of these areas has the concentration of chlorides increased over what it was a year ago. The concentration of chlorides in the Biscayne, Little River area which have structures, has not increased materially. At one sampling point in May 9, 1946 we had a 15,330 p.p.m. of chlorides; on April 8, 1947 the sample from this same area had only 1,738 p.p.m. of chlorides. Another area has dropped from 2,889 p.p.m. on May 9, 1946 to 220 p.p.m. on April 8, 1947.

"For the Tamiami (no structure area) we have had an increase in concentration. On March 26, 1946 one area had 12,626 p.p.m.; this dropped to 196 p.p.m. in Sept. 12, 1946; and the sampling on March 12 shows that we had 1,250 p.p.m. of chlorides in this area. Another point on the initial sampling we found 85,255 p.p.m. of chlorides and in Sept. 12, this had drepped to 225 p.p.m. The sampling on April 8, 1947 shows that the concentration is again increasing, 5,057 p.p.m. was found. To date results indicate that these structures are effective in keeping chlorides out of the area. Sampling of the Goulds, Military and North Canals, shows that the concentration of chlorides is increasing. In many cases the concentration has doubled. To date the structure on the Goulds Canal has been completed but the gates have not yet been installed. At present crews are putting in the structure on the Military Canal. At the present rate all of the structures on the major canals should be completed early this fall."

Drainage Studies - E. G. Diseker, Raleigh, North Carolina.- "Plymouth Experiment: All types of drainage are functioning, the bed drains and V-ditches appear to be the slowest type of drainage. Observations indicate that the tile lines, installed 4 feet deep, lower the water table faster than other installations, in spite of the fact that the outlet for these lines is submerged for a considerable period during heavy rainfall. Even before installation, plans were under way to eliminate the submerged outlet by one of two methods. One of these plans will be put into effect shortly, since there is a possibility of the tile main becoming congested with sand and sediment, even though it is functioning well at the present.

"Bethel Experiment: On the tile lines which were installed in April 1946, several depressions have appeared over the lines, which resemble sink holes or inverted funnel shapes. It has been suspected since October that sand has entered the lines at these points. On two occasions last fall, an effort was made to examine these suspected areas, but labor was not available. Later, when the soil was quite wet, it was not thought advisable to make an examination until all the lines had a free outlet, or until the soil was relatively dry. After the laterals were connected to the tile main an examination was made of all

suspected areas, also some areas that did not show indication of soil having entered the lines. After the examination, most of the joints were completely wrapped with roofing paper. Notes and measurements were kept of all areas examined. In some instances, where soil had entered the tile, there were slight openings below the mid-section of the tile joints, and in other instances there were no indications of an opening between the joints. These findings are listed in the following table:

| Tile line No. | Depth of Tile Installation | Distance from head-wall | Joints removed for examination | Evidence of soil entrance | Sediment depth in tile | Type of sediment |
|---|---|---|---|---|---|---|
| | Feet | Feet | | | Inches | |
| 1 | 2 | 120 | 5 | Yes | 1-1/2 | S F.S. |
| 1 | 2 | 260 | 4 | No | 0 | - |
| 2 | 2 | 260 | 4 | No | 0 | - |
| 3 | 2 | 200 | 5 | No | 1/4 | F.S. |
| 4 | 2 | 152 | 5 | Yes | 1 | F.S. |
| 4 | 2 | 216 | 5 | Yes | 1-1/2 | F.S. |
| 5 | 2 | 400 | 4 | No | 0 | - |
| 6 | 3 | 300 | 3 | No | 0 | - |
| 7 | 3 | 500 | 3 | Nc | 0 | - |
| 8 | 3 | 72 | 6 | Yes | 1-1/2 | S & F.S. |
| 9 | 3 | 77 | 7 | Yes | 1-1/4 | F.S. |
| 9 | 3 | 183 | 4 | Yes | 1-1/4 | F.S. |
| 10 | 4 | 100 | 3 | No | 0 | - |
| 11 | 4 | 65 | 7 | Yes | 1-1/2 | S & F.S. |
| 11 | 4 | 167 | 5 | Yes | 1-3/8 | S & F.S. |
| 12 | 4 | 62 | 5 | Yes | 1-1/4 | S & F.S. |
| 12 | 4 | 452 | 5 | Yes | 1-1/4 | S & F.S. |
| 13 | 4 | 194 | 5 | Yes | 1-3/4 | S & F.S. |
| 13 | 4 | 206 | 5 | Yes | 2 | S & F.S. |
| 13 | 4 | 495 | 60 | Yes | 1/2 to 3 | S & F.S. |

S = Sand
F.S. = Fine sand
Note: Soil separates were not examined by a soil technician.

"Some of the sections of tile which had the joints completely wrapped at the time of installation will be examined when more labor is available. There was no evidence on the soil surface above the tile lines to indicate soil entrance where the joints were completely wrapped.

"It stands to reason that the greatest soil leaks in the tile lines have already occurred, because of the fact that the soil above the lines should have become more stabilized with time. It is also reasonable to believe that a greater quantity of soil would have entered the tile lines had free outlets been present in all cases. The soil would then have been distributed over a greater length down the tile, due to a more rapid movement of water and soil into the tile, and to an increased velocity in the tile line, even though some of the smaller particles such as silt, clay and colloid would no doubt have been washed out of the lines.

"Drainage from the V-ditches and bed drains is slower than that of the open ditches and shallow tile. Water will stand in the low depressions over the tile lines and near the deep tile lines, for several days after moderately heavy rains. This is true especially where the old ditches were eliminated. The most of the soil available for filling these ditches was top soil and it is quite likely that this soil was puddled due to an appreciable quantity of water being present in the ditches when they were filled. In the vicinity of the deep tile, the soil appears to be inverted, in that the impervious strata is near the surface. However, this may drain better in the future since the lines have a free outlet and too, this area was sown broadcast to soy beans last year, and it is planned to cultivate this area in row crops this season."

IRRIGATION DIVISION

Water Requirements at Los Banos, California - Harry F. Blaney, Los Angeles, California.-"At the request of Operations an analysis was made of climatological and irrigation data and the following estimate of normal monthly water requirements for alfalfa was compiled for the Los Banos area, California:

| Month | Mean temperature (t) | Consumptive use factor (f) 1/ | Coefficient (k) 2/ | Consumptive use (u) 3/ | Irrigation requirement 4/ |
|---|---|---|---|---|---|
| | Degrees F. | | | Inches | Inches |
| April | 62.0 | 5.50 | 0.70 | 3.85 | 4.63 |
| May | 67.8 | 6.69 | .80 | 5.35 | 7.13 |
| June | 74.4 | 7.36 | .85 | 6.26 | 8.86 |
| July | 79.8 | 8.02 | .90 | 7.22 | 10.30 |
| August | 78.5 | 7.41 | .90 | 6.67 | 9.51 |
| September | 73.0 | 6.11 | .85 | 5.19 | 7.23 |
| October | 64.7 | 5.06 | .80 | 4.05 | 5.33 |
| Total | | | | 38.59 | 52.99 |

1/ f = mean monthly temperature x monthly percent of daytime hours.

2/ k = coefficient determined by experiments in other areas.

3/ u = kf = computed monthly consumptive use.

4/ Based on irrigation efficiency of 70 percent and corrected for rainfall.

Three-day Irrigation School, Lubbock, Texas - Ivan D. Wood, Denver, Colorado.-"Conducted 3-day irrigation school at Texas technical college, Lubbock, Texas. School was sponsored by Extension Service and in charge of arrangements were W. M. Williamson, District Agent; Knox Parr, District Agent; and M. R. Bentley, Agricultural Extension Engineer. Sessions were attended by about 50 persons made up mostly of county agents, members of the faculty of Texas Technological College, Soil Conservation and Bureau of Reclamation personnel. In addition to this school, farm meetings were held in the evening at Amherst, 72 present; Plainview, 47 present; Hereford, 41 present; and Texline, 45 present. At each evening meeting a clinic was held after the formal session. At these clinics problems of the individual landowners were worked on the blackboard."

Snow Surveys - Willis C. Barrett, Logan, Utah.-"The new belt-treads on the No. 1 (First) snowmobile were put through a rather grueling test and, as far as the test went, the treads proved satisfactory.

"The second, or No. 2 snowmobile is well under way, the style of which is radically different than the No. 1 snowmobile."

Dean K. Fuhriman, Logan, Utah.-"Snow surveys made in Utah near the end of April at a few scattered courses showed about a normal accumulation of snow during the month and it is expected that forecasts of streamflow made a month ago can stand substantially the same as then reported. Low elevation snow cover over the entire state has melted and either gone into ground storage or appeared as runoff. This absence of low-elevation snow cover eliminates the possibility of any spring floods from melting snows in any section of the state although supplies will hold up well during the late season over the state in general."

James C. Marr, Boise, Idaho.-Comparison of 1946 forecasts with recorded streamflow for seven stations in the Columbia River Basin have been made by Mr. Marr and associates. The following table reveals a striking accuracy of forecasts:

| Stream | Measuring station | Actual flow Acre-Feet | Forecast Acre-Feet |
|---|---|---|---|
| Columbia River | Birchbank, B. C. | 47,000,000 | 43,400,000 |
| Columbia River | The Dalles, Oregon | 106,470,000 | 100,000,000 |
| Kootenai River | Leonia, Idaho | 9,479,000 | 9,800,000 |
| Salmon River | Whitebird, Idaho | 6,047,000 | 6,600,000 |
| Snake River | Moran, Wyoming | 859,000 | 800,000 |
| Snake River | Heise, Idaho | 3,397,000 | 3,350,000 |
| Boise River | Above Diversion | 1,903,000 | 1,900,000 |

Homer J. Stockwell, Fort Collins, Colorado.-"The water-supply outlook as of April 1, based on snow surveys, was normal or above in Montana, Wyoming and in Colorado, except on the Rio Grande, San Juan, and Dolores Rivers. In New Mexico the snow cover is much below normal and in Arizona the water supply derived from snow will be negligible. Reports were issued on April 9, 10 and 11.

"The third annual meeting of the Colorado River Forecast Committee at Los Angeles was attended on April 16. About 50 were in attendance, representing organizations interested in Colorado River Water. Forecasts for the flow of the Colorado River from April 1 to July 31, 1947 were made by 9 different individuals for the record. These varied from 7,640,000 to 9,300,000 acre-feet. The Weather Bureau estimated in their reports at less than 7,000,000. My estimate was 8,900,000."

R. A. Work, Medford, Oregon.-"West-side water supply outlook for 1947 is for severe water shortage in Pacific Southwest, but with improvement progressively to the north, with generally ample water supplies in the northwest and a comfortable situation in areas east of the Continental Divide, but with widespread shortages in Rio Grande Basin."

Evaporation Losses at Measured Stations in Texas - Dean W. A. Bloodgood, Austin, Texas.-"The evaporation loss at Buchanan Dam station for March from a Weather Bureau pan was 5.51 inches; from a Bureau of Plant Industry pan, 4.16 inches and from a Division of Irrigation pan, 3.98 inches. The total precipitation for the month was 2.67 inches; total wind movement 3,895 miles; mean maximum temperature, 67 degrees F., and mean minimum temperature, 39 degrees F. At Mansfield Dam (Marshall Ford) during March, the evaporation loss from a Weather Bureau pan was 4.40 inches and from a Division of Irrigation pan 3.61 inches. The total precipitation for the month was 1.63 inches; total wind movement, 2,699 miles; mean maximum temperature 68 degrees F."

Sub-irrigation Near St. Anthony, Idaho - E. C. Gwillim, Corvallis, Oregon.-"In Madison County, Idaho, a rather unique system of irrigation is employed. The distribution canals on portions of the Henry's Fork Valley have been constructed as one would normally expect, but the water is not spread over the fields by either field laterals or borders as is normally done. The water table is maintained at practically constant level by percolation through the gravels in the bottom and the banks of the canals. After years of trial the farmers have been able to stabilize the water table and the land is sub-irrigated rather than by surface application. None of the water is lost to the stream as some of the water returns to Henry's Fork and the Snake River and some of it apparently follows some older river channels to the Mud Lake Area."

Rainfall Penetration, Upper Santa Ana, California - Dean C. Muckle, Pomona, California.-"Soil samples were taken at 35 locations during the month to determine the depth of rainfall penetration. On dry-farmed and other unirrigated areas the penetration averaged about 11 feet. On irrigated areas the penetration was greater owing to higher fall soil moisture content and also to winter irrigations on some crops."

Seepage from Irrigation Channels - Carl Rohwer, Fort Collins, Colorado.-"Final copy for publication of Seepage from Irrigation Channels is nearing completion. This report contains the results of seepage observations made in California and Colorado by various methods on lined and unlined canals and laterals, and includes a discussion of the importance of seepage as well as the hydraulic principles involved."

California Evaporation Report - Arthur A. Young, Pomona, California.- "The California Evaporation Report was completed and sent to the Berkeley Office for editing and to the State Engineer's office at Sacramento for examination and approval. Final editorial corrections are yet to be made."

Drainage Districts in Utah - J. Howard Maughan, Logan, Utah.-"The results of drainage in districts of Sevier County, Central Utah, are somewhat typical for districts elsewhere in the state. Of nine organized districts in this area, seven installed drainage systems. After the organization, two districts encountered costs and other problems, which so discouraged the farmers that action was discontinued and the drains were never installed.

"The seven districts which installed drains have tile systems. All these districts partially failed financially during the late 1920's and 1930's. In the resulting refinancing or final settlement, each district received a substantial discount on its bonded debt, ranging from 33-1/3 to 80 percent of the outstanding obligations.

"Two districts failed in their drainage operation and no longer maintain their systems. Two others partially failed and now inadequately maintain the drains with the result that much of the land receives little or no value from the drains. At the present time, there are only three districts which maintain their drains in full operation. But these systems indicate the possibilities of drainage in Sevier County. Operation of the drains in these districts has been so systematized as to insure the effective drainage of the areas served. The lands are outstanding in productivity and drainage leaders freely concede that without adequate drainage their lands would soon again develop a high water table and pass out of cultivated crop production.

"Purpose of the Utah drainage district project is to study and report the problems and accomplishments of drainage by Utah drainage districts, including the causes for success and failure during a third of a century of district operation."

5/22/47